Advancing Organizational Performance: A Strategic Framework to Multiscale Modeling and Simulation

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Abstract. In the modern, fast-moving, and technology-centric business world, the importance of service desks in swiftly and effectively addressing tech-related challenges cannot be overstated. The changing nature of work environments, particularly with the rise of remote and hybrid models post-pandemic, highlights the critical need for a simulation strategy that goes beyond individual departments to include the broader organizational context across various levels. Focusing on this need, we embarked on a project using Discrete Event Simulation (DES) to tackle the operational hurdles faced by the service desk of a leading UK-based telecommunications firm, marking the beginning of a larger initiative aimed at multiscale modeling and simulation (MMS). We have formulated a robust five-phase strategic framework to elevate and enhance organizational performance by applying a detailed DES analysis to refine the service desk operations. This framework examines the potential for targeted improvements within the service desk to have wider benefits, impacting everything from staff satisfaction and efficiency to the overall resilience of the organization.

Keywords: Discrete Event Simulation (DES), Multiscale Modeling and Simulation (MMS), Operational Efficiency, Organizational Performance

1 Background Research

The idea behind multiscale modeling and simulation (MMS) is based on the understanding that numerous systems display emergent behaviors and characteristics. These emerge from the interactions of simpler components at smaller scales yet cannot be seen at these scales in isolation. Multiscale modeling has emerged as a pivotal methodology in various scientific domains, enabling researchers to bridge the gap between phenomena occurring at multiple scales. In biological systems, it has facilitated a deeper understanding of processes from the molecular to the organism level, revolutionizing fields such as genomics and proteomics [1]. Similarly, in material science, multiscale modeling has been instrumental in predicting material properties by linking atomic-scale interactions with macroscopic behavior, leading to advancements in developing novel materials [2]. Furthermore, climate studies have benefited from multiscale modeling by integrating global climate models with regional processes to improve the accuracy of climate predictions and understand local climate impacts [3]. Despite these successes, the application of multiscale modeling within an organizational

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DOI: 10.1007/978-3-031-63775-9_32

context has not been extensively explored. This oversight represents a significant opportunity for organizational researchers to apply multiscale modeling techniques. By doing so, they can uncover intricate organizational dynamics, from individual behaviors to collective outcomes, offering new perspectives on organizational theory and management practices.

In the context of organizational operations, the performance and resilience of an organization can be influenced by processes occurring at the level of individual departments, teams, and even the interactions between single employees [4]. By applying multiscale modeling to such systems, it is possible to simulate and analyze how localized changes, such as improvements in the efficiency of a service desk, can propagate through the organizational hierarchy to affect overall corporate performance. This approach enables decision-makers to identify leverage points where targeted interventions can yield the most significant benefits, optimizing resource allocation and strategic planning across the organization.

This paper analyzes and evaluates a service desk model serving internal employees within a well-known UK-based company in the telecommunications industry. A service desk is a central point of contact for all IT service-related queries and requests within an organization [5]. They play a critical role in ensuring technology-related issues are addressed efficiently, therefore minimizing downtime and queue times, ensuring business/service continuity, boosting customer satisfaction, reducing costs, increasing productivity, and improving overall quality, efficiency & performance of the service support delivery. Within the telecommunications industry, internal service desks are essential as any impact on internal day-to-day tasks could affect external customer services like broadband, voice, and data. Without the support process of the internal service desk constantly ensuring employees can continue their work flawlessly, the company's ability to deliver quality services could be affected, resulting in lost revenue and decreased satisfaction [6][7].

In summary, we lay the groundwork for a comprehensive multiscale simulation model by commencing with a discrete event simulation project that meticulously analyses and optimizes the internal service desk operations within the aforementioned company. This initial phase seeks to enhance service desk efficiency and employee productivity and serves as a crucial step toward understanding and improving organizational performance on a macroscopic scale. The outcomes of this project promise to offer valuable insights into the interconnected nature of company operations, thereby facilitating informed decision-making aimed at fostering systemic improvements across multiple levels of the organization.

The paper is structured into six main sections. The first section concisely delved into the significance of multiscale modeling and simulation within organizational contexts. The second section provides an overview of the conceptual model and methodological approach. The third section explains the analysis of the localized DES modeling. The fourth section discusses the integration of the findings of the localized DES into multiscale modeling and simulation. The final section summarizes the study’s findings, identifies opportunities for future research, and reflects on the study’s limitations.

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2 Development Approach

2.1 Proposed Conceptual Framework

This section outlines the methodological approach adopted in our study, focusing on using discrete event simulation (DES) to improve the efficiency of service desk operations within the telecommunications company. The DES project is conceptualized as the initial phase of a multiscale simulation roadmap designed to enhance organizational transformation and performance. Our objective with the DES phase was to identify process inefficiencies and bottlenecks and to optimize service desk operations. This established a foundation for examining broader impacts on the company in subsequent research. Figure 1 represents this suggested roadmap from the microscale to macroscale impacts, illustrating the expansion from DES to multiscale modeling and simulation.

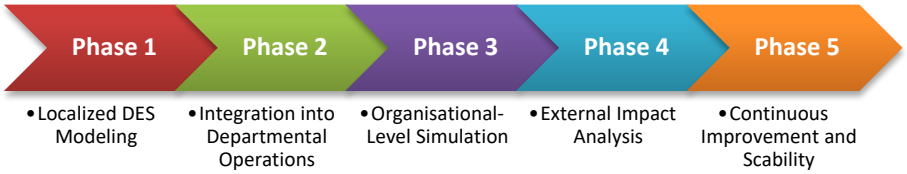

Fig. 1. Multiscale simulation roadmap to organizational performance

Considering the research context, in Phase 1, the focus is on Discrete Event Simulation (DES) with the objective of analyzing and optimizing the operational efficiency of the internal service desk. This includes improvements in a number of Key Performance Indicators (KPIs), such as the number of requests completed, queue times, and resource utilization. The expected output from this phase is enhanced business processes using both static (e.g., BPMN via Visual Paradigm software) and dynamic (e.g., Simul8 software) modeling methods.

Moving into Phase 2, the framework aims to integrate the findings from the DES into departmental operations. The goal is to apply the optimized service desk model to simulate its impact on related departmental operations, such as IT and HR. This will involve the development of agent-based models (ABM) or system dynamics (SD) models that interact with the outcomes of the DES. The output from this phase is improved operational strategies for interconnected departments.

Phase 3 expands the scope to an organizational-level simulation. The objective is to assess the cumulative impact of DES-based improvements on overall organizational performance. This involves expanding the simulation to include organizational metrics such as overall productivity, employee satisfaction, and cost-effectiveness, with the output being strategic insights for organizational restructuring or policy adjustments.

In Phase 4, the project shifts to an external impact analysis. The aim is to explore the effects of internal optimizations on external stakeholders, including customers, partners, and suppliers. This phase utilizes multiscale modeling to simulate interactions between the organization and its external environment, with the output focusing on

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strategies for improving customer service, supply chain efficiency, and partner collaboration.

Finally, Phase 5 focuses on continuous improvement and scalability. The objective is to establish a framework for ongoing optimization and scalability to new challenges or opportunities. This includes implementing a continuous feedback loop using real-world data to refine simulations and models, ensuring the organization remains resilient, adaptable, and capable of proactively responding to future changes.

2.2 Tailored Approach for DES Simulation Modelling

As mentioned previously, the aim of this project was to improve the efficiency and optimize the performance of the telecom's internal service desk process using static & dynamic modeling. This is the first phase of the previously proposed conceptual framework. A tailored approach that represents a step-by-step guide to our research scenario was adopted [8]. An AS-IS (i.e., current state) model was developed to identify existing problems in the service desk process. This model was then analyzed to develop a TO-BE (i.e., improved future state) model, which proposes solutions to improve bottlenecks and enhance overall efficiency. The TO-BE model also aims to improve key process metrics, including resource utilization, number of completed requests, and total queuing time. The illustration below shows the adopted process flow to fit the research context and acted as an overall guide when developing models & simulations for the telecommunication internal service desk scenario (Fig. 2).

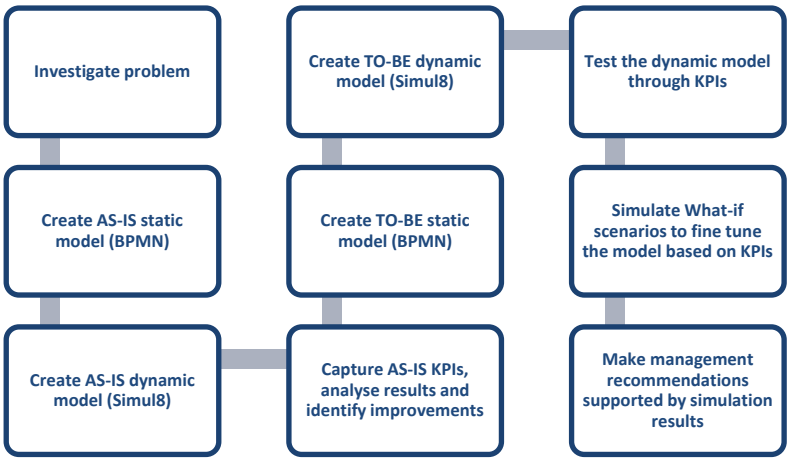

Fig. 2. Tailored simulation methodology for this research

2.3 Data Collection

We employed a mixed-methods approach, integrating both qualitative and quantitative research methodologies to enrich our investigation and enhance the robustness of our findings. The initial phase of our research was grounded in qualitative methods. We

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gathered nuanced insights into the operational mechanisms at play through techniques such as interviews, participant observations, and document analysis. This qualitative exploration was instrumental in developing a detailed understanding of the processes, which we subsequently represented through Business Process Model and Notation (BPMN) diagrams. Creating these diagrams was a crucial step, as it allowed us to visualize and conceptualize the complex processes in a structured and coherent manner, facilitating further analysis.

Building on the rich, contextual insights derived from our qualitative research, we transitioned to the quantitative phase of our study. In this phase, we designed and administered structured surveys to collect numerical data relevant to the previously identified processes and variables. The quantitative data collected through these surveys were pivotal in developing dynamic simulation models. These models enabled us to measure KPIs, offering empirical evidence to validate our qualitative findings and theoretical assumptions.

2.4 Data Evaluation

In this project's initial data analysis phase, Microsoft Excel played a pivotal role in processing the raw data to extract meaningful insights. By calculating average values over four months, we ensured that the analysis accounts for seasonal variations and avoids biases arising from analyzing data from a single, atypical month, such as December, when service desk requests may drop due to holidays.

The subsequent analysis stage focused on evaluating the outcomes generated by these models. This evaluation involved a detailed comparison of KPIs before and after implementing proposed improvements across several simulation trials to achieve up to 95% confidence levels. The KPIs under scrutiny included the number of requests completed by the service desk, average queue times, and resource utilization rates of the 1st and 2nd level support team agents and those of the High Priority team agents within the internal service desk.

The Discrete Event Simulation (DES) model developed as part of this research underwent rigorous verification and validation to ensure its accuracy and reliability. This critical step was essential to confirm that the model accurately represents the service desk's real-world processes and performs as intended under various conditions. By comparing the model's output against known benchmarks and real service desk data, we established its validity.

3 Analysis

With the use of multiple IT solutions within the TO-BE process, such as conversational automation, artificial intelligence, and centralized data stores, a KPI increase of 208% in the average number of requests completed was recorded. This almost doubled the previous set monthly benchmark of 10,000 average requests solved monthly, improving overall efficiency and support quality as more were solved within the same monthly period. Additionally, the resource utilization of agents from each team is at an ideal

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utilization level of around 60-75% +, reducing the chances of burning out and impacting job satisfaction (Fig. 3).

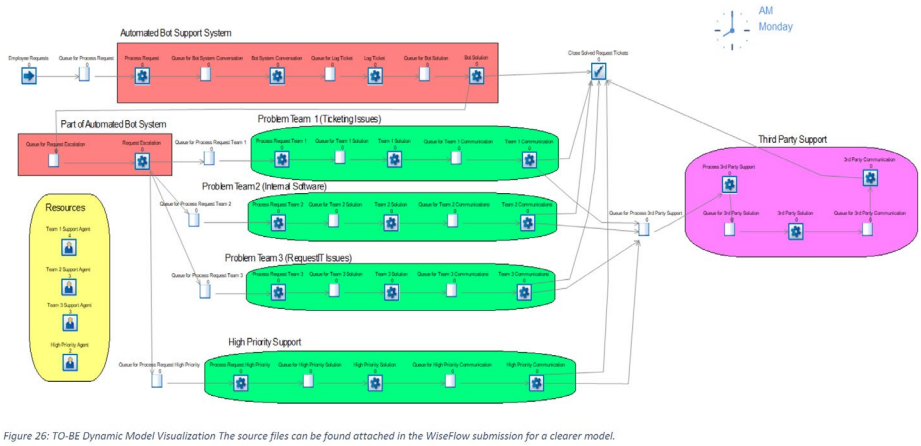

Figure 26: TO-BE Dynamic Model Visualization The source files can be found attached in the WiseFlow submission for a clearer model.

Fig. 3. TO-BE Dynamic Model Visualization using Simul8 Software

The introduction of automation and conversational bots alongside the re-creation of service desk support resulted in a 30% decrease in average queue times from start to end, which signifies the increase in efficiency as the teams are dealing with requests quicker, making employees wait for a shorter time which increases support satisfaction. Furthermore, the experimental "What-if" approach was used to reduce the total number of resources from 30 to 12 agents while still having increased requests completed with shorter queue times compared to the AS-IS model results. The automation has streamlined the process and reduced the load on multiple teams by successfully triaging requests and providing solutions with no human intervention. Although the high-priority team utilization stands out and appears to be high compared to other resources, this can be justified as while the high-priority teams deal with fewer requests, their workflow involves more tasks that are more difficult than those of other teams (Table 1).

Table 1. AS-IS & TO-BE dynamic model's KPI comparison.

Key Performance Indicator	AS-IS Model	TO-BE Model
Average number of requests completed	8,222 requests	25,377 requests
Average queue time in the system	43,776 minutes	30,508 minutes
1st Level support agent utilization	94%	60%
2nd Level support agent utilization	86%	72%
3rd High Priority agent utilization	39%	78%

The application of discrete event simulation (DES) findings from service desk optimizations in a telecommunications company presents a compelling case for its extrapolation into broader, multiscale modeling and simulation endeavors. By enhancing the

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efficiency of service desk operations, we not only achieve immediate operational improvements but also lay a foundational framework for assessing and enhancing departmental and organizational-wide processes. This highlights the interconnected nature of organizational functions and the cascading effects of localized improvements.

4 Discussion

The decision to adopt a multiscale simulation approach stems from the recognition that improvements in service desk efficiency have the potential to impact various levels of an organization. The DES findings offer a micro-level view, which is crucial for understanding how changes can affect broader organizational dynamics, including inter-departmental workflows and overall customer satisfaction. Upon the successful optimization of service desk operations, characterized by significant reductions in queue times and improvements in resource utilization, the subsequent step involves the dissemination of these findings across various departments, for instance, IT and HR.

In the telecommunications company's internal service desk, the findings from the first phase of localized DES have direct implications for the processes within the IT and HR departments. For instance, the IT department can draw on these findings to refine the ticketing system, ensuring that it not only classifies queries by urgency but also directs them to the appropriate IT specialist based on the type of issue, which could range from software glitches to hardware malfunctions. This approach could be complemented by the introduction of a chatbot for initial troubleshooting, allowing IT professionals to focus on resolving more complex problems, especially during periods identified by the DES as having high incident reports.

Similarly, the HR department might implement a self-service portal that addresses the most common employee inquiries, freeing up HR personnel to deal with more sensitive or complex issues. Prioritization of issues could be particularly crucial during peak times, such as pay periods or benefits enrollment seasons, ensuring that HR resources are allocated effectively to manage the influx of employee queries.

Moreover, integrating DES findings within these departments can be enriched by employing other techniques like agent-based modeling and system dynamics, which offer a multi-scale perspective of the impact. Agent-based modeling can simulate the interactions of individual agents, such as IT and HR personnel, with each other and the system, capturing the mechanisms behind their choices. On the other hand, system dynamics provides a high-level view of the entire organization, highlighting how changes in one department can have ripple effects throughout the company. Together, these modeling techniques can offer a comprehensive view of the service desk's operations, supporting strategic decisions that enhance efficiency and employee satisfaction across the organization.

5 Conclusion

In conclusion, this study addresses the gap in the literature regarding optimizing organizational efficiency through multiscale modeling and simulation. While multiscale

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modeling has proven to be a transformative approach in other fields, its application within an organizational context remains relatively unexplored. This gap presents a unique opportunity for researchers to pioneer the adaptation and implementation of multiscale modeling and simulation techniques to uncover new insights into organizational structures and behaviors, thereby extending its benefits beyond the traditional domains.

This paper contributes to the existing literature by proposing a novel strategic framework for implementing multiscale simulation modeling within organizations through DES modeling. The second phase of the proposed strategic roadmap focuses on applying the insights gained from the localized DES models, such as reducing queuing times and optimizing resource utilization, to improve departmental efficiencies. This research has limitations, such as data gaps, as we were only provided with four months of operational data. Also, the research is based on some assumptions as not all the data could be provided due to the company's policies. In addition to this, the research assumed that resource availability was 100% daily, meaning, the agents would not take days off or fall sick.

Future research can extend the analysis to examine the cascading effects of service desk optimizations on the telecommunications company. Subsequent phases will investigate departmental interactions, overall organizational efficiency, the impact on customer satisfaction, and organizational resilience by employing a combination of ABMs, SD models, and potentially other multiscale simulation techniques. Furthermore, applying the suggested model to other organizational contexts may be necessary. Additional investigations into this model could refine the model's comprehensiveness and fulfill its purpose of enhancing organizational resilience.

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DOI: 10.1007/978-3-031-63775-9_32